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EDITORIAL

MUCH TO BE THANKFUL FOR

The weeks of unfavourable weather at a time when harvest operations should have been in full swing on British Farms, resulting in heavy financial loss to those who till the land, once again serves to emphasise that mushroom growers, by and large, have much to be thankful for.

Not only were the corn crops badly affected, but horticulturists too stood by helpless whilst the incessant rain ruined flowers, outdoor tomatoes and many other crops. The weeds too grew in abundance and thereby further hampered operations.

Mushroom growers however, producing their produce under cover, with everything, relatively speaking, under control, had little to worry about as regards the weather and, indeed, there seems little real doubt that they benefited from the continued bad spell of unsettled conditions, so unlike the previous year when the hot spell brought its own peculiar problems to growers.

True the mushroom grower and the horticulturists in general has to exist as best he may without the aid of government subsidies, but such subsidies, in the main, are consumer subsidies pure and simple and, as such, are not required by us—simply because demand continues to keep pace with the ever increasing supplies, and prices on the whole, remain pretty stable. Price fluctuation there certainly is at times, but rarely if ever is it as violent as, for instance, it is in the case of the cabbage grower, the producer of green peas and so on.

It is right and proper, in times such as those which have just passed, that our sympathy should go out to those who have not and are not as fortunate as ourselves. For in spite of our own ever present difficulties from the various pests and diseases which always menace our crops, in spite of the sudden and oft unexplained crop failures, we have, as an industry, much to be thankful for.

WRA

CONTROLLING THE MILDEW DISEASE OF THE CULTIVATED MUSHROOM*

B. B. STOLLER, R. E. WEST, and J. F. BAILEY

Abstract

A rapid laboratory procedure is described for selecting fungicides that inhibit the growth of the *Dactylium* mildew. The results of the laboratory procedure compare favourably with the results of field tests, especially for eliminating ineffective fungicides. Of the 32 chemicals or fungicides tested, Terraclor was found most satisfactory. Experiments with Terraclor in mushroom houses have shown that this fungicide can eradicate the *Dactylium* mildew even after the mildew is well established on the beds and, also, that it has a relatively long residual effect.

INTRODUCTION

The mildew fungus, *Dactylium dendroides*, is well-known to mushroom growers and has been described in detail by Beach (2). It grows over the casing soil after the soil has become permeated by the mushroom mycelium, as well as attacking and growing over the sporophores of the cultivated mushroom, *Agaricus compestris*.

According to some investigators in the field of mushroom culture (3), the mildew diseases have become in some areas a greater menace than other pests. Fungicides commonly used in mushroom culture, zineb and hypochlorite, failed to control *Dactylium* mildew (3). In a recently published procedure for controlling mushroom diseases with chlorinated water (1), it was found that the mildew disease could not be controlled with chlorine.

With so many new fungicides available nowadays, it is difficult to make a selection of those that should be tested on the mushroom beds. A preliminary laboratory test for eliminating and selecting suitable fungicides is imperative. Fortunately, the growth response of the mildew fungus lends itself readily to a rapid laboratory test.

LABORATORY PROCEDURE

The procedure is simply to inoculate mushrooms with the mildew tissue and spores that are taken directly from the mushroom beds. In this way the host tissue remains the substrate and the virulence of the disease organism is not impaired, as it might be by pure culture. In this procedure pint jars or disposable plastic cups are fitted with a tray made of a square, wire cloth (the usual aluminum fly screen). This screen is pushed down in the centre so that the four corners of the square serve as a support. The tray is pushed down to one inch from the bottom of the container, and some water is added below the tray for humidification. (A piece of tissue paper might be placed over the tray screen to increase evaporation). Then a few washed, wet mushrooms from which the stubs have been cut off are placed on the screen tray and

*Contribution of Research Laboratory, West Foods of California, Soquel, California.

Table 1. Effect of various chemicals in ppm on the *Dactylium mildew**

		Parts per million									
Trade name	Chemical	10,000	5,000	4,000	2,000	1,000	500	200	100	50	25
NITRO AND/OR CHLORO BENZENES & PHENOLS											
Terraclor	Pentachloronitrobenzene ..			-	-	-		-	-	-	+
Dowicide A	O-Phenylphenol, Na Salt ..	-	-			-	-		-	-	+
Dowicide G	Pentachlorophenol, Na Salt ..	-	-			+					
Dowicide G	In distilled water ..	-	-			-					
Dowicide 7	Pentachlorophenol ..	-	-			+					
Fusarex	Tetrachloronitrobenzene ..	-	-					+			
Sanocide	Hexachlorobenzene ..				-	-	+	+			
—	Cresylic acid ..	-	-			-	-		+		
—	2, 4 Dinitrophenol ..				+		+		+		
Elgetol	Na dinitro ortho cresylate ..			+		+			+		
Pittsburgh B-622	2, 4-dichloro-6-(O-Chloroamili- no)-S-Triazine ..			+	+		+		+		
SULPHUR COMPOUNDS											
Nabam	disodium ethylenebis dithiocarbamate ..			0	+	+					
Zineb	Zinc salt of Nabam ..			+	+	+					
Vancide 51	Na dimethyldithiocarbamate & Na 2-mercaptobenzothiazole			0	+	+					
Vapam	Na N-methyl dithiocarbamate					-	-	-		+	
AMMONIATING COMPOUNDS											
—	Ammonium hydroxide ..	-				+			+		
—	Urea ..	+	-			+	+				
—	Methenamine ..					-		+		+	
—	Dimethylamine ..			-		+			+		
ANTIBIOTICS											
Acti-dione	Cycloheximide ..							-	+	+	+
Fradicin	— ..							+	+	+	+
Terramycin	— ..								+	+	+
PLANT GROWTH SUBSTANCES											
2, 4D	2, 4-dichlorophenoxy acetic acid ..					-	+		+		+
—	A-naphthalene acetic acid, Na salt ..					+		+		+	+
—	Maleic hydrazide, Na salt ..					-	-		+		
MISCELLANEOUS CHEMICALS											
Omazene	Copper dihydrazin sulfate ..				+	+	+				
Stauffer N-1045	— ..					+	+				
Perchloron	Calcium hypochlorite ..	+	+		+	+					
Cunilate #2472	Copper-8-quinolinolate (soluble) ..				-	+	+	+		+	
Roccal	Alkyl-dimethyl-benzyl- Ammonium chloride ..	0	+		+	0	+		+		
BTC	Alkyl-dimethyl-benzyl- Ammonium chloride ..		+			0	+		+		
Isothan Q-15	Lauryl isoquinolinium bromide ..				-		-	+			
—	Formaldehyde ..	-	-			0	+				

* *Dactylium* mycelium regrew, +; no growth, -; variable, 0.
Concentrations calculated on active ingredients.

inoculated. The top of the container is covered with a sheet of polyethylene film 0.001 inches thick and fastened down with a rubber band. The polyethylene film permits an exchange of respiratory gases but prevents the escape of moisture; a humidity of 100 per cent. is desirable for rapid growth. The containers are incubated at about 60° F. so that the mushrooms will not mature too fast.

In a few days the mildew should have made a good initial growth. Then the water in the bottom of the container is poured off, and the mushrooms on the screen are sprayed with 50 mls. of the fungicides at various concentrations. The usual atomizer is satisfactory for spraying, but in these tests an "oil-can" type sprayer fitted with a plastic atomizer nozzle was used. The mushrooms are turned with a forceps in the course of being sprayed in order to reach every part of the tissue. The container is covered again and shaken thoroughly so that the mushrooms and other material on the screen are wetted from underneath also. The screen is raised, if necessary, to prevent it from coming in contact with the 50 mls. of liquid left in the bottom of the container after the spraying. The containers are incubated at 60° F. After 48 and 72 hours, observation is made for re-growth of the mildew fungus. Results are reported in Table 1. The identity of the mildew fungus as *Dactylium* was confirmed by a specimen sent to Dr. T. T. Ayers of the U.S. Department of Agriculture. It is not ruled out, however, that other mildews might have been present also.

EVALUATION OF FUNGICIDES BY LABORATORY PROCEDURE

Terraclor and Dowicide A inhibited the growth of the mildew at the lowest concentration, namely, 50 ppm. Field tests with these fungicides will be discussed later. Several of the nitro and chloro derivatives of benzene and phenol, which are structurally similar to Terraclor, were also inhibitory, but at a higher concentration. Pentachlorophenol, commonly used in one form or another to spray bed boards and as a general disinfectant around mushroom houses, was only mildly inhibitory when dissolved in the usual tap water. A flocculent precipitate was formed in the stock solution when Dowicide G was dissolved in this water of medium hardness (hardness as CaCO_3 —132 ppm, total dissolved solids 223 ppm). Apparently the insoluble calcium salt of pentachlorophenol is not as effective as the soluble sodium salt.

The dithiocarbamates are one of the most widely used fungicides for spraying and dusting mushroom beds. Therefore, it is important to note that these chemicals are comparatively ineffective against the mildew. The fact that Vapam is highly inhibitory would indicate that the decomposition products of the dithiocarbamates are severely toxic to the mildew but that other dithiocarbamates, such as zineb or nabam, are insufficiently decomposed by or in the presence of the mildew to be toxic at low concentrations. The rapid volatilization of poisonous vapours arising when Vapam is diluted with water prevents its application on mushroom beds. But Vapam is being used in place of formaldehyde, chloropicrin, etc., to fumigate the casing soil before casing the beds.

It was thought at first that the volatilization of ammonia was one of the important mechanisms for the inhibiting effects exhibited by chemicals with a nitrogen group, especially since volatile ammonia was initially observed with Terraclor. Furthermore, volatile ammonia was found to inhibit or delay the germination of the spores of other fungus diseases of the mushroom, namely, truffle, *Mycogone* and *Verticillium* (4). The volatilization of ammonia was easily detected by the phenol red-paper test (4) about 24 hours after spraying. In later tests, however, volatile ammonia was detected after spraying with chemicals that were not inhibitory.

Of note in Table 1 is the fact that urea was inhibitory at 5,000 ppm, but not inhibitory at higher or lower concentrations. At 5,000 ppm volatile ammonia was strongly detectable, whereas slight, if any, ammonia was found at the other concentrations. For an explanation it might be supposed that urea was suitable as a substrate for micro-organisms at a concentration of 5,000 ppm; or the tissue of the mildew or of the mushroom contained the enzyme which was able to decompose urea at this concentration. The obvious explanation for the inhibitory effect of methenamine is that the acid reaction of the mushroom or *Dactylium* tissue induced the decomposition of methenamine into ammonia and formaldehyde.

The antibiotics tested were found non-inhibitory at an economic level. Plant growth substances were not inhibitory at the usual low concentrations in which these substances exhibit their hormone-like effect. Of the other chemicals studied, it was disconcerting to find that the copper salts of hydrazine and quinol were relatively ineffective. It is interesting and significant to note that many of the chemicals employed by mushrooms growers as disinfectants, such as pentachlorophenol, nabam, zineb, Elgetol, copper salts, hypochlorite and Roccal, were all relatively ineffective against the mildew.

COMPARISON OF TESTS IN LABORATORY AND ON MUSHROOM BEDS

In the initial phase of this investigation when no satisfactory control was available, considerable mildew was present on the beds. Accordingly, corresponding tests with some of the chemicals were made by spraying spots of *Dactylium* on the beds. The chemicals tested were zineb, nabam, chlorine, ammonia, Terramycin, Acti-dione, Dowicide A, and Terraclor.

When spots of the mildew on the beds were dusted heavily with zineb, or sprayed with the highest concentrations of zineb or nabam as shown in Table 1, the mildew mycelium usually regrew within 48 to 96 hours. The mildew spots were dusted with a powder containing 15% calcium hypochlorite, as suggested in one of the references (3). In this case the mildew grew right through the dusted area. In the laboratory tests 14,000 ppm of available chlorine did not inhibit the growth of the *Dactylium* mycelium, even though the chlorine was volatilizing in the bottom of the container and surrounding the tissue with chlorine vapour (as detected by odour). At 14,000 ppm the mildew mycelium grew more

Table 2. Effect on yield when a suspension of mildew spores and Terraclor were sprayed on the surface of the soil at time of casing

Tray No.	Trays inoculated with mildew	Terraclor included			Yield lbs. per sq. ft. in 7 weeks
		Trays with Terraclor	*Grams per 18 lbs. of soil	ppm	
1	none	none	—	—	1.5
2	+	+	1.0	100	1.7
3	+	+	4.0	400	0.9
4	+	+	10.0	1,000	0.1
5	+	none	—	—	1.0
6	+	none	—	—	1.5
7	+	none	—	—	0.9
8	none	+	4.0	400	0.7
9	none	+	10.0	1,000	0.2

*Grams of 75% wettable powder.

oppressed and slower than at half this concentration. So these results confirm the ineffectiveness of chlorine to inhibit *Dactylium* in the references cited (1, 3).

Spots sprayed with a 1 per cent. solution (10,000 ppm) of ammonia water usually remained clear of *Dactylium* for seven days or longer. Sometimes new spots of mildew were found a few inches from spots sprayed with the ammonia. Possibly the spores blown away by the pressure of the spray germinated later. Besides not being consistently inhibitory when sprayed on the beds, the odour of ammonia filled the whole house and made the room uncomfortable for the pickers.

Growth of *Dactylium* on the beds was not prevented by spraying with 100 ppm of Terramycin; even at this concentration this is not an economical fungicide. Acti-dione sprayed on the beds was relatively effective at 200 ppm, but the number of tests was insufficient to draw conclusions. However, considering its toxicity and cost, Terraclor is preferable.

Although both Terraclor and Dowicide A were inhibitory at 50 ppm in the laboratory tests, concentrations ten times as great were required to eradicate the mildew established on the mushroom beds. It is understandable that the mildew mycelium is below the surface of the casing soil, so that the fungicidal sprays are not accessible to all parts of the tissue as in the laboratory tests. Spray solutions of 500 to 1,000 ppm of Terraclor inhibited the recurrence and spread of the mildew for five weeks or longer. Dowicide A inhibited the regrowth of the *Dactylium* for only about ten days. Accordingly, Terraclor has a greater residual value, or is more toxic to spores of *Dactylium* than is Dowicide A.

It may be concluded from the sampling of fungicides in the field tests that fungicides found ineffective by the laboratory procedure are also non-inhibitory in the field tests. But for fungicides found effective in the laboratory tests, complementary tests on the mushroom beds are necessary in order to select the best fungicide for practice.

EXPERIMENTS WITH TERRACLOR IN MUSHROOM HOUSES

Experiments with Terraclor were conducted in the mushroom plant of West Foods of California in Soquel, California. Plots of 50 sq. ft. of bed space were sprayed with Terraclor in concentrations of 100, 250, 500, 1,000 and 2,000 ppm. While no records were kept of the yield, the plots were observed daily. The plots were sprayed after the mushrooms were picked off. The mushrooms which grew subsequently were not spotted or in any way impaired by the spray. As far as could be observed, there was no decrease in yield, except possibly a small reduction at 2,000 ppm. In smaller plots, the mushrooms were sprayed directly with 500 and 1,000 ppm; no spotting occurred. Mushroom beds dusted after the first break with 20% Terraclor powder at the rate of 1 lb. per 1,000 sq. ft. of space produced in some instances 2 lbs. of mushrooms per sq. ft. in five to seven weeks (cropping period). The mushroom spawn grew normally in houses where the bed boards were sprayed with 75 per cent. wettable powder of Terraclor at the rate of 1 lb. per 100 gallons of water (about 1,000 ppm). Accordingly, Terraclor is not toxic to the mushroom or spawn when these procedures are practised.

Experiments were also conducted by spraying Terraclor on the casing soil as shown in Table 2. *Dactylium* mycelium and spores taken directly from an infected bed were suspended in water. This suspension was used to spray the casing soil of trays having a surface area of 7 sq. ft. Suspensions of the mildew were also mixed with various concentrations of Terraclor, as shown in Table 2, and then sprayed on the casing soil. Solutions of Terraclor without *Dactylium* were also used. The soil was sprayed immediately after casing the trays.

The "pest house" where these tests were conducted was heated with a small gas heater. The dry heat tended to dry the bed surfaces despite repeated watering. No *Dactylium* or any mildew was observed during the seven weeks the trays were cropped; presumably the dry atmosphere was not conducive to the germination of the mildew spores. Another reason for lack of mildew growth may be that the trays were kept completely free of trash or stubs. Usually the mildew is discovered after the third or fourth break on small, "dry" pins, and then grows over normal mushrooms. Also, the insecticides concurrently tested in the "pest house" may have been toxic to the mildew spores. The mushrooms harvested from these trays were all of good quality and no spotting was observed.

No conclusion can be drawn about the effect of Terraclor on mildew spores under these circumstances, since the mildew spores without treatment failed to germinate. But the data in Table 2 is of interest to show the effect of Terraclor on the yield of mushrooms. On the basis of the single test it may be stated, tentatively, that Terraclor, sprayed

at the rate of 100 ppm immediately after casing the beds, will not decrease the yield. But when the rate is 400 to 1,000 ppm, the yield will be reduced sharply. These results apply to spraying at the time of casing, and not to spraying after the mushroom mycelium has grown into the soil.

In another test 50 and 100 ppm of Terraclor were mixed with the casing soil in a small cement mixer and then used to case 24 sq. ft. of bed surface. While no records were kept of the yields from these plots, there is little doubt that the crop was delayed and the yields reduced even by mixing 50 ppm Terraclor with the casing soil. Relatively few mushrooms grew on these plots. So, from these results, Terraclor should not be mixed with the casing soil.

SUMMARY OF PRACTICES WITH TERRACLOR

1. The bed boards may be sprayed with Terraclor (75 per cent. wettable powder) at the rate of 1 lb. per 100 gals. of water (1,000 ppm) before the beds are filled with compost.
2. After the first break is picked off, the beds may be sprayed with 500 to 1,000 ppm of Terraclor or dusted with 20% Terraclor at the rate of $\frac{1}{2}$ to 1 lb. per 1,000 sq. ft. of bed space. (Applied for control of *Dactylium* mildew.)
3. Immediately after casing the beds might be sprayed with Terraclor at the rate of 100 ppm. (Only one test as a basis for this practice.)
4. Spraying the soil immediately after casing with 400 ppm or more of Terraclor will result in a reduction in yield.
5. The yield, apparently, is reduced by mixing as little as 50 ppm of Terraclor with the casing soil.

These experiments with Terraclor were conducted with a peat soil containing 50 per cent. organic matter. These results and conclusions apply strictly to a soil of this nature. Whether these results are applicable to soil containing the usual 5 per cent. organic matter will have to be determined by actual tests. However, it seems reasonable to suppose that these results should apply for the practices after the first break of mushrooms.

It might also be noted that water of medium hardness, as previously described, was used to dissolve the chemicals, except in the one instance referred to in Table 1.

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My Way of Growing

SNOWCAP MUSHROOMS LTD.



*Mr. M. C. Luxmoore (right) and Mr. J. Gooding passing the compost shed.
Note the straw bales used as a wind break.*

Of the Yaxley, near Peterborough, mushroom growers, Snowcap Mushrooms Ltd., practically adjoining Noble Mushrooms Ltd. (described in the September *MGA Bulletin*) is very much the junior partner, for it was only established in 1951.

Snowcap is owned by Mr. M. C. Luxmoore ("Coryn" to his close friends) who, after a spell abroad, commenced mushroom growing in 1936. He started growing at Combe Bank Gardens, Sundridge, Kent, where Major A. L. A. Dredge, now operates with considerable success. Combe Bank was previously owned by Sir Robert Mond, well-known breeder of Suffolk Punches. The stables for these horses were extensive and had already been converted to mushroom houses when Mr. Luxmoore arrived.

During the war years Combe Bank was taken over by the R.A.F., and used as workshops. After the war, Mr. Luxmoore continued in partnership at Combe Bank with Mr. H. N. Ball (now at The King's Arms, Rotherfield) but, with the partnership dissolved, Mr. Luxmoore moved to Yaxley and thus Snowcap Mushrooms came into being.

This farm of Mr. Luxmoore's, planned from scratch, is well laid out with 15 brick built, cavity walled houses, each containing approximately 1,300 sq. ft., on the shelf system, to give a basic area of around 18,000 sq. ft. Two houses were added only recently.

As the accompanying picture shows, the compost yard is at the top of a gentle slope with the houses running terrace fashion the whole length of the farm. Thus house filling is made somewhat easier and, to forestall any obvious criticism to the effect that the reverse is the case when a house is being emptied, let me hastily add that Snowcap dispose

of their used compost quite quickly with a lorry on call to clear the house on schedule, so this presents no problem whatsoever.

Snowcap grow on the shelf system and, like their neighbours, use only synthetic compost. In fact no horse manure whatsoever has been used since the farm was first built. Peat is used for casing, "although we came up here specially to use Yaxley clay," said Mr. Luxmoore, somewhat wryly.

As in the case of its neighbour, synthetic compost is made exactly to the MRA formula, with Activator 1 added at stacking and 2 at what Mr. Luxmoore describes as "the final shake up." Long composting is practised with the first turn after stacking at 5-6 days, followed by two more turns at five day intervals and, of course, that final "shake-up." Water is added at the first stacking and is pumped back from a sump.



*Mr. Luxmoore (left) standing in his laboratory.
Mr. Ben Noble, of Noble Mushrooms Ltd.*

Heating is by coke fired boiler and not water, and the peak heat takes place in the houses with large electric tubular heaters providing the necessary boost to bring the temperature to 132° F.—this temperature is held for a period of 24 hours. The compost is spawned when it drops to 80° F. and the time to case is determined always by the condition of the spawn run. With regard to the spawn run, Mr. Luxmoore is firmly convinced that a dryish compost is far the best. He holds

the view that, if the compost is on the wet side, the spawn runs to the top, whilst if it is too dry it runs to the bottom.

Since this would be the natural reaction of plant life—running deeper and deeper in search of moisture—there would appear to be sound logic in Mr. Luxmoore's contention. If the compost, nearing completion, is found to be too wet, gypsum is added but, says Mr. Luxmoore, "that means that somewhere along the line a mistake has been made." As for the spawn run itself, Mr. Luxmoore prefers the run to be at a temperature of about 72° F.

A growing temperature of 60° F. is maintained and normally casing takes place ten days after spawning. Grain spawn is used. First pick invariably takes place 21 days after casing. Three crops are taken per year, with an average of 21 lb. per sq. ft. Efforts are now being made to increase the number of crops taken per year. "I think it could be more and we shall certainly try to increase the number of crops," says Mr. Luxmoore.

Mr. Luxmoore, with his experience of both horse manure and synthetic, comes down heavily in favour of synthetic compost although, as he himself put it, "Synthetic compost is far more difficult than horse

manure." In its original state, 3 tons of baled wheat straw are used per 1,000 sq. ft. of bed space. The beds are 7 inches deep.

Grower-Manager to Snowcap Mushrooms and also a Director of the firm is Mr. Jim Gooding, who has been with Snowcap since it first began its highly successful existence.

Mr. Luxmoore himself is a keen supporter of the MGA, was one of the earlier members, has served on the MGA Executive Committee and on the old Mushroom Research Association Board. WRA



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MUSHROOMS AT THE BRITISH FOOD FAIR

Pre-pack Pointer

Mushrooms were an excellent selling line on the NFU produce stand at the British Food Fair which concluded its run of nearly three weeks at Olympia on Saturday, 15th September.

During that time approximately 1,800 lb. of mushrooms were sold, all in pre-packs. This figure represents no fewer than 4,800 separate packs.

For practically the first time it was possible to compare the direct public reaction to two types of pre-pack, the $\frac{1}{2}$ lb. cardboard window type pack in more general use and the new type 6 oz. pack now being marketed by Messrs. A. G. Linfield Ltd. Pictures of both types of pack appeared in the last issue of the *MGA Bulletin*. **It appears quite certain that the 6 oz. pack in acetate bags was much preferred.**

Senior NFU Horticultural Secretary, Mr. H. R. Haynes, who managed the whole of the NFU stand, commented afterwards, "I must confess that at first I was prejudiced against the bag type of pack. It seemed to me that the mushrooms would travel badly for one thing. However, that was not the case and in my opinion the bag type as used by Messrs. Linfield, and provided they contain button mushrooms, are 1st class. I watched the buying public and questioned several. There was no doubt at all that the buyer liked to see everything contained in the pack and this they were able to do with the bag type. I wouldn't like to express an opinion as to what the reaction would be and how the produce would travel if cups or flats were so packed, but it would be an interesting experiment."

In addition to selling mushrooms and distributing literature from the information centre attached to the stand—about 20,000 copies of "Winning Ways" and a like amount of "Mushrooms Month by Month"—mushrooms were also evident in other parts of Olympia.

They were featured, for instance, in cooking demonstrations on the British Electrical Development Association's stand where the demonstrations were given by that well-known Television personality, Marguerite Patten. Jean Conil, the celebrated chef, also used them in connection with his Bovril cooking demonstrations. The Kenwood Company from Woking were another concern who, manufacturing food mixing machines, used mushrooms in many demonstrations.

To return to the NFU stand, growing mushrooms attracted the customary attention and the trays for these were supplied and delivered by Mr. A. J. Berry, of The Dell Mushroom Farm, Ruislip Common, Middx. Messrs. A. G. Linfield Ltd. of Thakeham, and Mr. Raymond Thompson of West Wittering, supplied the pre-packs, and Mr. Guy Reed of Woking sent the mushrooms for special display purposes. The stand was visited by a number of MGA members including Mr. G. W. Baker (Chairman), Mr. G. V. Allen (Vice-Chairman) and members of the Publicity Sub-Committee.

PINHEADS

(For amusement only—apparently)

131. A clot has just called. "Can you show me round the place?" he asked. "Why?", I snarled, after guessing the answer: "I want to start growing mushrooms." "In a big way?" I asked. "No, just a few in the garden." I counted ten, metaphorically poised the boot and replied, "But it would only confuse you to show you a lot of empty houses." The boot metaphorically kicked: "Go, buy a book and learn how it's done." Despair was the clot's companion as he departed with an inimical "Good Morning."

132. Can our research people tell us what would be the effect of applying warm peat for casing—peat insufficiently cooled after steaming?

133. (Watch the italics.) You will expect me to say *a word* about the quite unnecessary Open Letter of last month. If Fred. Atkins has a fault—and *I would be the last to deny it!*—it is his chronic inability to understand what I say or write; he can't "fit" the "parts" together because he *deliberately* makes no effort to do so. He accuses me of swashbuckling buffoonery in a particular matter on the one hand and *applauds* my generosity, skill and penetration on the other. As far as I know he is almost the only person, *hide-bound by his textbook complex as he is*, who can't separate the wheat from the chaff in my crops of *mental food*. If I follow a serious statement or belief by a piece of "buffoonery" he supposes the whole lot to be stupid. He steadfastly refuses to believe I mean what I say—except when I say anything of which he approves *or which, dare I say it? magnifies his prestige; I have watched him expand his chest and straighten his tie on these occasions!* Worse still, and *in spite of a recent week-end's indoctrination*, he prefers to take me out of context whenever he can. How completely he misunderstands or misreads me. I don't "champion the Ordinary Man in his Struggle against Progress." But I **do** champion him in his struggle against **lack** of progress. If this were an Open Letter to Mr. Atkins I would say (*and he wouldn't believe that I meant it!*): "You, F.C., as the teacher and master, set an extraordinarily bad example to your pupils (a) when you admit you read Pinheads at all—or was it only the late Diary you read?; *certainly you don't read Pinheads intelligently*; and (b) when you are the very first to insist that at all costs Pinheads must not be stopped. As a stickler for Truth (*as you understand it*) you should neither read *a pack of lies (as you believe)* not permit such to be published *for the eternal demoralisation of all (as you think) growers.*

It is one of the tragedies of modern times that everything must become more and more complex. Higher education, higher intellect, brainier brains are responsible for this growing complexity, so that the more brilliant the brain the more difficult it expects everything must be—or what would be the use of the extra grey matter? Simplicity in reading, understanding, perception are unacceptable, as is plain common sense. It is with this in mind that I, *a simple uninhibited type*,

have tried to help Fred (C), a highly-intellectual intellectual type, to sort out the wheat from the chaff by the elementary device of using italics. Perhaps I should explain for his benefit that it's the *chaff* in italics!

134. Scene: an insurance office. A client was discussing his son's and daughter's various Life policies. Having dealt with his son's he asked "Can you tell me when my daughter's have matured will they continue to attract interest?" Singular, isn't it!

135. I am seriously jeopardising my chances of remaining in business by putting down one synthetic compost to every four or five stable manures. I take off my hat to those Midland wizards and others (straighten that tie, Atkins) who are entirely on synthetic and doing so very well. I just can't get their results or anything near them and I would like to be able to blame someone for it. With great reluctance I have to confess that I can only 'blame myself' and am accordingly giving myself a piece of my mind—a most interesting experience!

136. It has been suggested that the British Productivity Council should do a Work Study on my place. I'm a little hesitant about it following the impression of a very astute observer who after being shown round a large factory where a "Study" was taking place remarked that the only people in the whole building who were patently not working were the Work Study group.

137. We have just acquired a Luft Weather Set (£6. from Degenhardt & Co., 32 Maddox Street, London, W 1), which is a combined thermometer, barometer and hygrometer. It is German-made and very compact, neat and efficient-looking. Checked against other instruments it appears to be accurate in all particulars, though how long it will remain so is anybody's guess. By plotting readings of pressure, temperature and humidity every two or three hours one should (assuming continued accuracy) ultimately have some very valuable data. I'd be interested to know if anyone else thinks this way.

138. If a public weighbridge is too small to take the four wheels of a lorry the custom is to take two weights, first the forward end (two wheels on the weigh) then the back end (two wheels), add the two weights and "Robert's your father's brother." Is this a reliable method? I can't quite see why it should be—nor yet why it should not!—but some of our weighmasters don't seem to agree with our load estimates. We've had a half load of light strawy compost weigh more than a full load of heavy wet stuff.

139. "I would willingly stand down to make way for junior members," said one of our Executive Committee. But where are these junior members? Where are the young growers of to-day? Who's going to follow us "Old 'uns"? Do you have to grow beyond youth before you find the fascination that puts all other jobs in the shade?

140. If a single cock can produce 3,643,703 offspring in a year what could a married one do? And talking of cocks reminds me of the unofficial motto of some war-time air squadrons: "No bastardo barbarandum," which freely translated means "Never let the bastards grind you down."

THOUGHTS ON COMPOSTING

*"Quot Homines, Tot Sententiae"**—

and the Latin tag was never truer than when applied to mushroom growers and their methods of composting! From the ultra-short brigade, through the two-phase gentlemen to those who stick to traditional methods there is almost infinite variety in such matters as numbers of turns, period between turns, length of peak heat, temperature and so on. There are



variations on a theme such as the triangle men, those who extol the virtues of the split lump, and more recently, the 'no-composting-at-all' school of thought. All these earnest seekers after truth pursue the same goal—more pounds of mushrooms per unit of input.

It is a good thing that in such a divided world they have *one* factor upon which they can rely, no matter what method of composting they follow. Whether the medium is short or long, DARLINGTON'S 100% SPAWN will give consistently good results.

* *"There are as many opinions as there are men."*

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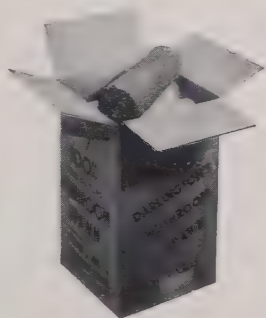
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COME TO EASTBOURNE

G. W. BAKER (MGA Chairman)

That long-awaited event, the Annual Mushroom Industry Exhibition, takes place at Eastbourne on 14th and 15th November, and growers, representing a thriving industry will, the organisers hope, converge on the Winter Garden in ever increasing numbers.

It is with particular pleasure, both as Chairman of the MGA, Chairman of the Organising Committee and as a grower pure and simple, that I tell you that for this, the fifth exhibition and conference, the lecturers will be Mr. C. R. Rasmussen, head of Danish Research, and whose papers at the Third International Conference on the subject of compost in particular, created such widespread interest; Mr. F. W. Toovey, now Director of Research at the Glasshouse Crops Research Institute, Littlehampton, who will outline the suggested mushroom research programme at Littlehampton, and finally one of the leading tray system growers in this country, Mr. J. Stewart-Wood, who will talk on a subject close to his heart, farm mechanisation, and will give lantern slide illustrations on how he tackles this thorny problem on his own farm.

Preliminary timing of the lectures are:—Wednesday, 14th November, 2.30 p.m., Mr. Toovey and 3 p.m., Mr. Stewart Wood; Thursday, 15th November, 2.30 p.m., Mr. Rasmussen.

The complete preliminary programme was printed in the September *MGA Bulletin* and you will have already seen that, by way of experiment, a dinner and dance will be held at The Grand Hotel on the evening of 14th November. All of us connected with the organisation are hoping that this will be well attended. Tickets are 30/- each and details of application will be circulated within the next week or so.

There is little doubt that the “get together” in the same hotel on the eve of the exhibition—this proved extremely popular last year—will attract many growers, their wives and friends.

Throughout the two complete days cookery demonstrations are being arranged and, in addition, it is hoped to have an Elizabeth Arden representative to talk to the ladies at The Grand Hotel, on the morning of 15th November.

Another innovation will be the showing of several films, at times to be announced later. There is the twenty minute film taken on my own farm at Oxted, but I would emphasise that it is simply a mushroom farm film, not one advertising the Broadham Produce Co. It was produced by Esso Petroleum Co., and is in colour. Certainly it pleased the MGA Executive Committee at a preview in London.

I need say but little about the mushroom competitions which, all are hoping, will receive record support. Please enter—it makes so much difference.

To our friends in the trade I take particular pleasure in extending a cordial welcome. We have tried this year to take growers away from

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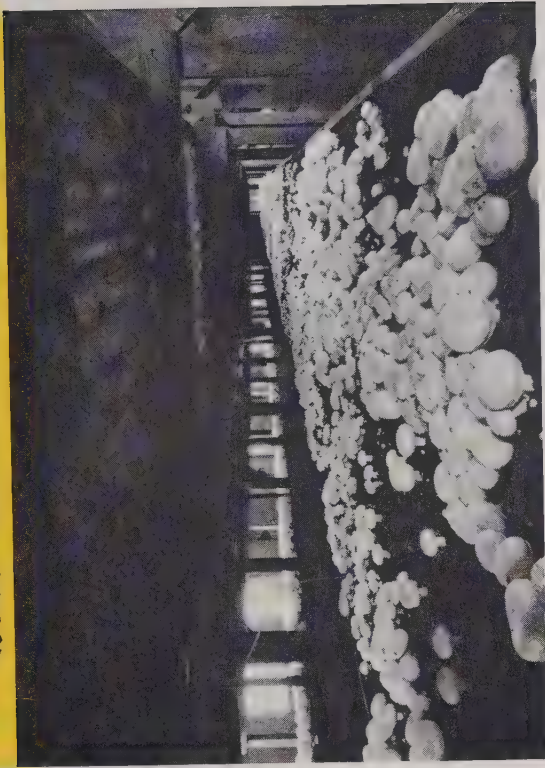
Dear Sirs,

Please find enclosed photograph of mushroom crop, also record card to date 31.7.56. The area of sq. ft. being 1,800, you can see it has produced over 2 lbs. per square foot in 30 days. The quality of mushroom has been extremely good, and I can assure you that no mushroom has been cut with any long stalks to make weight.

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the exhibition hall as little as possible—about an hour and a half each day.

Lastly, as you know we are not a very rich organisation and expenditure on this annual effort is quite heavy. In order to offset this a little this year and to cover the cost of the lectures and the identification badges, a small charge of 5/- is to be made to all who wish to attend—a sort of delegate's fee.

A warm welcome then to each and every one of you.

NORTHERN IRELAND FARM WALK



Some of those who took part in the Northern Ireland Farm Walk, described below.

United Kingdom and Eire mushroom growers turned out in surprisingly good numbers for a farm walk organised by the MGA and held at Mrs. Young's Mountsandel Nurseries, Coleraine, on Saturday, 22nd September.

This was the first farm walk organised by the MGA in Northern Ireland and, with between 60 and 70 growers taking part, the event was a real and satisfying success.

In all, the Young nurseries have nearly 120,000 sq. ft. of mushroom beds, all on the shelf system. The late Mr. Young started mushroom growing some 51 years ago, first on ridge beds and later on shelves. The firm must thus be regarded as the senior mushroom growing undertaking in Northern Ireland and Eire.

In view of the houses in use—these include at least one large house at Mountsandel and three or four previously disused flax mills—a surprising degree of production efficiency has been achieved and serious attacks of disease avoided. Indeed, growers who crossed the Irish sea for this farm walk were much impressed with the display of mushrooms and the cropping records, the more so when they learned that some of the old flax mills have been used for mushroom production for many years.

Mr. Eric White, manager, and nephew of Mrs. Young, welcomed the visitors and conducted them round, first of all giving a brief outline of the methods in use and the general lay out. Afterwards he answered many questions.

Among other things he explained the great difficulty experienced in the matter of adequate supplies of horse manure, in spite of long haulage which sometimes involved a lorry in a 300 mile trip in a single day. It was this shortage of horse manure, especially in the summer months, which led to Mr. White experimenting with pig manure. This followed his visit to the farm of Messrs. A. G. Linfield Ltd., at Thakeham, Sussex, in July. At the moment a combination of horse and pig manure is being tried out and, with a fine spawn run, all is so far well.

Many weeks production lost through the horse manure shortage (a chart showed that the spread over of house idleness due to lack of manure amounted to as many as sixty weeks last summer), pin-pointed the need for urgent action in the matter of manure supplies.

Following the farm tour the visitors were entertained by Mrs. Young at her spacious and well-appointed home.

After tea, a brains trust session was presided over by the MGA Chairman, Mr. G. W. Baker, supported by Mr. White, Prof. Muskett, Head of Plant Pathology and Dean of the Faculty at Queen's University, Mr. Taylor (Assistant to Prof. Muskett), Mr. R. G. Darlington (W. Darlington & Sons Ltd., Worthing), Mr. Robert Patterson (Mon-Lough Food Production Co. Ltd.) and Mr. Donald Freeborne (Cowling Group, Salesmen, Leeds).

Among the replies given by Mr. White were the following: He cropped for a period of 12 weeks, found that Basudin controlled stroma, the pig manure he was using was very strawy, he always used steam heat and formaldehyde on the expended beds and houses before emptying.



Mrs. Young (picture by courtesy of "The Grower.")

The Mountsandel concern uses peat and limestone for casing, but Mr. Patterson stated he used three parts peat to two of limestone and one of ashes. To a question asking about the effects of publicity, Mr. White said that 90% of the Mountsandel production went to English markets and since the publicity campaign prices had been much firmer. In addition they had received enquiries for supplies from many other market salesmen. Mr. Freeborne said his firm had no doubt that the firm prices maintained by mushrooms against substantially increased supplies had been due to the publicity. There was no doubt that the general public was very much more mushroom minded.

Should stalks be marketed? was another question which excited discussion. Mr. Bleazard said he found that when pickers were asked to take care of stalks he found that too little stalk was being left on the mushroom itself and, in consequence, there was a loss of income. A similar experience was voiced by Mr. Patterson who said his firm no longer marketed stalks. To a question about research in Northern Ireland, Prof. Muskett gave a brief history of the steps so far taken and on the method of approach to the whole matter as far as Northern Ireland was concerned. He paid full tribute to the late Mr. F. W. Young, a pioneer amongst N. Ireland mushroom growers. The policy of those responsible for research in Northern Ireland was to prove certain theories in the field and not leave them as laboratory or trial proofs only.



Mrs. Young (centre right) pictured outside her picturesque and attractive country home. With her is Mrs. White, Mr. Eric White (right) and Mr. G. W. Baker (MGA Chairman).

It was inevitable that small mushrooms should be discussed and asked his opinion, Mr. Darlington said there was no doubt that strains of spawn could have a bearing on this, but he rather favoured the view that the chief cause was environment. There was no doubt at all that the rate of the food release in compost, to the mushroom itself, had great effect on the ultimate size, taking into consideration the cropping period allowed.

Thanks were afterwards expressed to Mrs. Young, to Mr. White and others.

For the English and Scottish members who had made the journey there was, next day, a visit to the Giant's Causeway, arranged by Mr. and Mrs. White. On the Monday, Mr. Robert Patterson entertained the English visitors to a tour of his firm's farms, a tour which, incidently, much impressed the visitors.

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Left: Mr. Eric White (see N. Ireland Farm Walk, page 332). Picture by courtesy of "The Grower."



Miss Maie Kolk of Woking, Surrey, whose appointment as Asst. Secretary of the MGA was confirmed at a meeting of the Executive Committee on 27th September.



JEAN CONIL FOR EASTBOURNE

Jean Conil, the famous chef, is to give cookery demonstrations during the Mushroom Industry Exhibition at Brighton. He will also assist with the judging of the mushroom competitions.

CORRESPONDENCE

My attention has been directed to some writings in your Bulletin which are of the greatest possible interest to two organisations with which I am intimately concerned, namely the World Association for Study of Phenomena by Unscientific Methods (W A S P U M) and the League of Observers of the Uselessness of Scientific Evidence (L O U S E). The writings I refer to are published under the title of "Pinheads" by one Stanley Middlebrook, and the one of particular interest is numbered 125 on page 288 of your October Bulletin. In this brilliant contribution to the world's sum of knowledge, a contribution made as all knowledge of real value is, without any pretence of the necessity for evidence, Middlebrook offers a revolutionary concept of the relation between richness of the raw material and the appropriate course of the composting process.

There is, however, some evidence which Middlebrook has overlooked, omitted to quote, or had not observed. This unawareness of evidence is a characteristic of thinkers with great intuition; the last one of similar calibre I recollect (.303 might be appropriate, suitably applied) was a painter named Schickelgruber, whose intuition defied all theorists in the unrelated field of military science.

But to return to the evidence. Anyone with an Intelligence Quotient (I.Q.) exceeding 50%, most mushroom growers and scientists thus being excluded, and an Index of Perception (I.P.) greater than 25%, which excludes the rest of them, must have noticed that the pale coloured, foul smelling part of a stack of manure, which forms in the lower central part of the cross section of the stack, is larger and forms sooner when the manure is rich in droppings. (The cross section of the stack is the triangular one Middlebrook made because he thought an Authority had told him to. When he discovered that no one had told him and he must have made it up, he or it or both became quite good tempered again.).

This characteristic pale colour and foul smell show that the manure has used up its oxygen supply and needs to be turned. The fact that these conditions develop quickly and are widespread establishes the need for turning after a short interval of only one, two or at the most three days; the richer the manure the shorter the interval. Now Middlebrook himself and also Sinden and his colleagues have shown that short intervals between turns are essentially characteristic of short total composting times. The shorter the total time the shorter the intervals must necessarily be.

Thus Middlebrook has proved his point that the rich manure is inherently suited to short composting, the richer the shorter; or possibly I have; or have we? As no one who matters is interested in the evidence, it only remains to express the appreciation of the two organisations I represent, for Middlebrook's genius as exemplified by this work. A proposal will be made to W A S P U M to elect him an Honorary Member. L O U S E, which is a much smaller body, has already recognised him as a kindred spirit and only awaits an opportunity of welcoming him into the fraternity.

LERNER V. LITTLE, *Doc. Pholi.*

Dr. R. L. Edwards suggests . . .

EVEN A PINCUSHION WILL TURN

Pinhead 116

I read this with unusual interest because, disappointing as it may be to Mr. Middlebrook, I am very much inclined to agree with him about the existence of a critical best casing time. It may be unkind to say that I was first inclined to agree with him on this subject about seven years ago, and further experiments in the next few years were in general agreement. In the experiments carried out at Yaxley, late casing, up to 21 days after spawning in one case and 24 days in another, gave the best yields and it was noted that there was a slow spawn run. The possibility was indicated that these actual times might not be best under other circumstances, but the probable importance of casing time was clearly indicated in MRA Ann. Rep. 1949. My comment in MRA Ann. Rep. 1951 was "It seems that growth of mycelium in uncased beds has some quality which is lacking in growth made after casing." As "growth made after casing" is presumably into the "compost still to be penetrated," Mr. Middlebrook may yet find himself in the deplorable situation of not disagreeing with me. My mental picture, which I think was freely expressed at the time, was that there was an ideal casing time for any particular compost and set of conditions, but I did not, as Mr. Middlebrook does, offer any theory as to the factors determining this time. In *Mushroom Science II* (1953) I said: "It appears to be harmful to case before the growth of spawn has reached a certain stage which we can only describe at present as being 'ready,' without being able to define it. It is clear that correct choice of times for casing can make a considerable difference to the yield." I had no experimental evidence to show that excessive delay in casing reduced the yield, although if carried to extremes this is obvious. Mr. Middlebrook is not hampered by such trifles as evidence, he just rushes in. I seem to remember some growers being sceptical about the importance of casing time, including a friend and neighbour of Mr. Middlebrook who quoted satisfactory crops cased immediately after spawning. Perhaps, now Mr. Middlebrook has either discovered the importance of casing time or come round to my way of thinking, they would like to fight it out between them.

Pinhead 115

Surely detailed records of the barometric pressure for the period 7th—9th July are available in the various places where these "unusual happenings" were observed, for comparison between place and place as well as with other periods? I suggest that "interesting support" for the theory that atmospheric pressure affects the rate of growth of mushrooms will be given when such a comparison has been made, and not before. I am not contradicting the theory, merely asking for any evidence to support it. Also, the temperature in French caves may not vary much (though I think a degree or two is an understatement), but the ventilation of many caves is entirely controlled, and in all of them it is greatly affected by the difference between inside and outside air temperature.

THIS PUBLICITY BUSINESS concerns YOU

Each month a list appears of those people who have supported the MGA's Publicity Scheme. There is something you can do to make this acknowledgment even more tangible.

If you want to try out a new market, if you want to give a new salesman a run, look down the list below and send your consignments to those who support this publicity bid of ours. By so doing you will help, not only them, but yourself at the same time. Not only does this apply to salesmen but to others in the industry who, by their contributions, enable some publicity to be given to the cultivated mushroom.

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Geo. Jackson & Co. Ltd., Salesmen, Smithfield Market, Birmingham	5	5	0
Thomas Elliott Ltd, Sundries, New Church Road, London, S.E.5	10	10	0
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H. Dowson & Co. Ltd., Salesmen, Newcastle-on-Tyne	1	1	0
J. W. Laws Ltd., Salesmen, Newcastle-on-Tyne	2	0	0
Dan Wuille & Co. Ltd., Salesmen, Covent Garden Market, W.C.2	50	0	0
J. Collingridge & Co. Ltd., Salesmen, Covent Garden Market, W.C.2	25	0	0
R. E. Jenkinson Ltd., Salesmen, Covent Garden Market, W.C.2	105	0	0
Ed. H. Lewis & Sons Ltd., Salesmen, Covent Garden Market, W.C.2	5	5	0
P. C. Brown, Biddulph, Stoke-on-Trent	8	6	8
J. N. Proctor, Minskip, York	5	16	0
R. J. McBriar, Overdale, Saintfield, Belfast	5	5	0
N. Olverson, Scarisbrick, Nr. Ormskirk, Lancs.	5	0	0
Stable Manures Ltd., Newmarket and Worthing	30	15	9
J. Jones & Sons, Salesmen, North Market, Liverpool	3	3	0
C. Snowdon & Co. Ltd., Salesmen, Castlefolds Market, Sheffield	18	16	2
*W. Darlington & Sons Ltd., Spawn Merchants, Worthing			
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